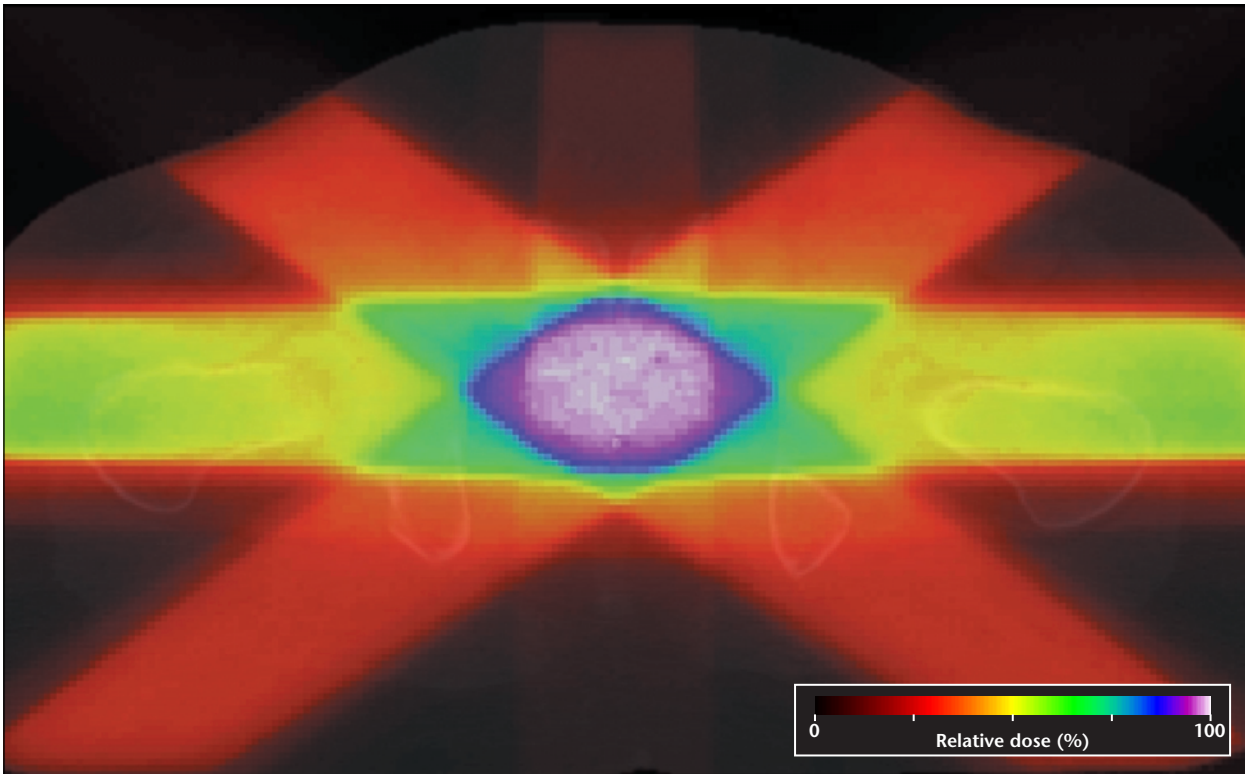


# PEREGRINE: PROSTATE



*Seven-field conformal boost to the prostate; 18 MV photon beams.*

## Introduction

PEREGRINE is a 3D Monte Carlo dose calculation system designed specifically for radiation therapy. The main advantages of Monte Carlo dose calculations are their robustness for a wide range of beam modifiers and beam geometries and their inherent accuracy in the presence of three-dimensional surface irregularities, missing tissue, and tissue heterogeneities.

Current dose calculation methods approximate dose distributions in the patient based on dose distributions in water. PEREGRINE determines the dose in the patient by directly simulating particle transport through both the beam delivery system and patient.

## Accuracy for Prostate

External beam radiation therapy of prostate cancer requires accurate dose calculations for a variety of field and patient characteristics. The measurement comparisons (on the reverse side) highlight PEREGRINE's accuracy for three dose calculation conditions that may be present in prostate cancer treatment plans: dose at depth for several field sizes, wedges (45° steel wedge), and a prosthetic-device

heterogeneity (steel). Comparisons are made for 6- and 18-MV photon beams.

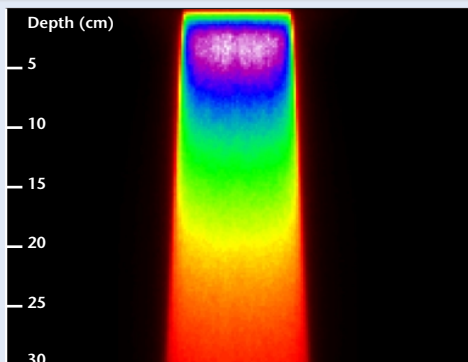
All measurements were made at the University of California at San Francisco on a Varian 2100C 6- and 18-MV photon beam using a Scanditronix photon diode (0.45 mm thick, 2.5 mm diameter, p-type silicon detector) or a Wellhofer IC-10 air-equivalent ion chamber (6 mm outer diameter, 0.4 mm wall thickness, 3.3 mm active length). All water phantom measurements were made at a source-to-surface distance of 90 cm.

All measurements and calculations are reported in absolute dose per monitor unit. Ion chamber measurements have been corrected for effective chamber position, but not for position-dependent variation in the electron energy spectrum in the ion chamber cavity, which could affect the accuracy of measurements in the buildup region ( $D < D_{\text{max}}$ ) and outside the beam penumbra.

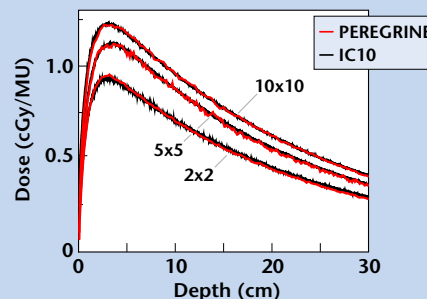
Results demonstrate PEREGRINE's accuracy for predicting absolute dose per monitor unit, dose at depth, transmission through wedges, and the effects of high-atomic-number heterogeneities on the distribution of dose.

## Dose at Depth

PEREGRINE uses first-principles physics to accurately predict dose for high energy photon beams

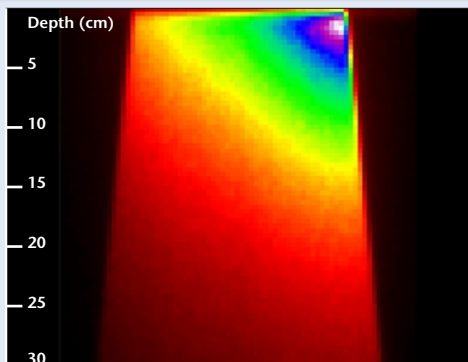


### Square Fields, 18 MV

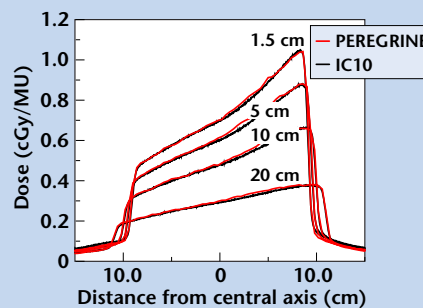


## Wedges

PEREGRINE provides robust, accurate dose calculations for beam modifiers including wedges

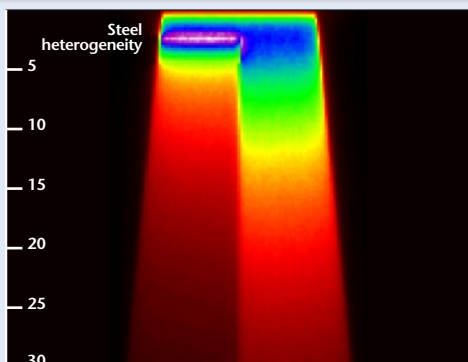


### 20x40 cm Field, 45 Degree Wedge, 6 MV

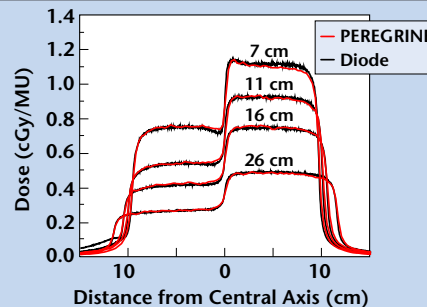


## Steel Heterogeneity

PEREGRINE 3D Monte Carlo transport of photons and electrons accurately models the effects of prosthetic devices



### 20x8 cm Field, 3 cm Steel Half Slab, 18 MV



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PEREGRINE is a work in progress. The PEREGRINE technology has been licensed to NOMOS Corporation for distribution.

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